Practice Chain Rule March 17th

Date_____ Period____

Differentiate each function with respect to *x*.

1) $f(x) = (2x^3 - 3)^2$

2) $f(x) = (-x^2 + 3)^4$

3) $y = (x^3 + 3)^2$

4) $f(x) = (5x^5 + 4)^2$

5) $y = ((2x^3 + 3)^5 - 3)^2$

6) $y = ((5x - 4)^5 - 1)^4$

7) $y = \left(-5x^4 - 2\right)^{\frac{1}{4}} \cdot \left(4x^2 - 3\right)^5$

8) $y = \left(3x + 2\right)^{-5} \cdot \left(4x^4 + 3\right)^{-4}$

9) $y = \dfrac{-3x + 1}{\left(5x^3 + 1\right)^5}$

10) $y = \dfrac{-2x^2 + 5}{\left(-5x^3 + 1\right)^3}$

11) $y = \sin\left(\cos x^3\right)$

12) $y = \cos\left(\sin 3x^3\right)$

13) $y = \sin\left(\sin 2x^3\right)$

14) $y = \sin 5x^5$

15) $y = \sec\left(\csc 2x^3\right)$

16) $y = \sec\left(\sec x^4\right)$

17) $y = (3x^5 + 1)\sin 4x^3$

18) $y = (x^3 + 5)\sin 4x^4$

19) $y = \dfrac{5x^3 + 2}{\sin 5x^2}$

20) $y = \cos \dfrac{5x^3}{2x^2 + 5}$

Answers to Practice Chain Rule March 17th (ID: 1)

1) $f'(x) = 2(2x^3 - 3) \cdot 6x^2$
$= 12x^2(2x^3 - 3)$

2) $f'(x) = 4(-x^2 + 3)^3 \cdot -2x$
$= -8x(-x^2 + 3)^3$

3) $\frac{dy}{dx} = 2(x^3 + 3) \cdot 3x^2$
$= 6x^2(x^3 + 3)$

4) $f'(x) = 2(5x^5 + 4) \cdot 25x^4$
$= 50x^4(5x^5 + 4)$

5) $\frac{dy}{dx} = 2\left((2x^3 + 3)^5 - 3\right) \cdot 5(2x^3 + 3)^4 \cdot 6x^2$
$= 60x^2(2x^3 + 3)^4\left((2x^3 + 3)^5 - 3\right)$

6) $\frac{dy}{dx} = 4\left((5x - 4)^5 - 1\right)^3 \cdot 5(5x - 4)^4 \cdot 5$
$= 100\left((5x - 4)^5 - 1\right)^3 \cdot (5x - 4)^4$

7) $\frac{dy}{dx} = (-5x^4 - 2)^{\frac{1}{4}} \cdot 5(4x^2 - 3)^4 \cdot 8x + (4x^2 - 3)^5 \cdot \frac{1}{4}(-5x^4 - 2)^{-\frac{3}{4}} \cdot -20x^3$
$= \frac{5x(4x^2 - 3)^4(-44x^4 - 16 + 3x^2)}{(-5x^4 - 2)^{\frac{3}{4}}}$

8) $\frac{dy}{dx} = (3x + 2)^{-5} \cdot -4(4x^4 + 3)^{-5} \cdot 16x^3 + (4x^4 + 3)^{-4} \cdot -5(3x + 2)^{-6} \cdot 3$
$= \frac{-252x^4 - 128x^3 - 45}{(3x + 2)^6 \cdot (4x^4 + 3)^5}$

9) $\frac{dy}{dx} = \frac{(5x^3 + 1)^5 \cdot -3 - (-3x + 1) \cdot 5(5x^3 + 1)^4 \cdot 15x^2}{\left((5x^3 + 1)^5\right)^2}$
$= \frac{3(70x^3 - 1 - 25x^2)}{(5x^3 + 1)^6}$

10) $\frac{dy}{dx} = \frac{(-5x^3 + 1)^3 \cdot -4x - (-2x^2 + 5) \cdot 3(-5x^3 + 1)^2 \cdot -15x^2}{\left((-5x^3 + 1)^3\right)^2}$
$= \frac{x(-70x^3 - 4 + 225x)}{(-5x^3 + 1)^4}$

11) $\frac{dy}{dx} = \cos(\cos x^3) \cdot -\sin x^3 \cdot 3x^2$
$= -3x^2 \cos(\cos x^3) \sin x^3$

12) $\frac{dy}{dx} = -\sin(\sin 3x^3) \cdot \cos 3x^3 \cdot 9x^2$
$= -9x^2 \sin(\sin 3x^3) \cos 3x^3$

13) $\frac{dy}{dx} = \cos(\sin 2x^3) \cdot \cos 2x^3 \cdot 6x^2$
$= 6x^2 \cos(\sin 2x^3) \cos 2x^3$

14) $\frac{dy}{dx} = \cos 5x^5 \cdot 25x^4$
$= 25x^4 \cos 5x^5$

15) $\frac{dy}{dx} = \sec(\csc 2x^3) \tan(\csc 2x^3) \cdot -\csc 2x^3 \cot 2x^3 \cdot 6x^2$
$= -6x^2 \sec(\csc 2x^3) \tan(\csc 2x^3) \csc 2x^3 \cot 2x^3$

16) $\frac{dy}{dx} = \sec(\sec x^4) \tan(\sec x^4) \cdot \sec x^4 \tan x^4 \cdot 4x^3$
$= 4x^3 \sec(\sec x^4) \tan(\sec x^4) \sec x^4 \tan x^4$

17) $\frac{dy}{dx} = (3x^5 + 1) \cdot \cos 4x^3 \cdot 12x^2 + \sin 4x^3 \cdot 15x^4$
$= 3x^2(12x^5 \cos 4x^3 + 4\cos 4x^3 + 5x^2 \sin 4x^3)$

18) $\frac{dy}{dx} = (x^3 + 5) \cdot \cos 4x^4 \cdot 16x^3 + \sin 4x^4 \cdot 3x^2$

$= x^2(16x^4 \cos 4x^4 + 80x \cos 4x^4 + 3 \sin 4x^4)$

19) $\frac{dy}{dx} = \frac{\sin 5x^2 \cdot 15x^2 - (5x^3 + 2) \cdot \cos 5x^2 \cdot 10x}{\sin^2 5x^2}$

$= \frac{5x(3x \sin 5x^2 - 10x^3 \cos 5x^2 - 4 \cos 5x^2)}{\sin^2 5x^2}$

20) $\frac{dy}{dx} = -\sin \frac{5x^3}{2x^2 + 5} \cdot \frac{(2x^2 + 5) \cdot 15x^2 - 5x^3 \cdot 4x}{(2x^2 + 5)^2}$

$= -\frac{5x^2 \sin \frac{5x^3}{2x^2 + 5} \cdot (2x^2 + 15)}{(2x^2 + 5)^2}$